Installation Instructions

PowerFlex® 70 Adjustable Frequency AC Drive

When reading this document, look for this symbol " **Step x** " to guide you through the 5 BASIC STEPS needed to install and perform a Basic Start-Up of the PowerFlex 70. A Human Interface Module (HIM) is required to perform the Basic Start-Up routine covered in this manual.

The information provided Does Not replace the User Manual and is intended for qualified drive service personnel only.

For detailed PowerFlex 70 information including advanced start-up routines, programming, application considerations and related precautions refer to the following publications online at **www.rockwellautomation.com/literature**:

Title	Publication
PowerFlex 70 User Manual	20A-UM001
DriveGuard Safe-Off Option (Series B) for PowerFlex 40P and PowerFlex 70 AC Drives	20A-UM003
PowerFlex Comm Adapter Manuals	20COMM-UM
Dynamic Braking Resistor Calculator	PFLEX-AT001
PowerFlex 70 and 700 Reference Manual - Volume 1	PFLEX-RM001
PowerFlex Reference Manual	PFLEX-RM004
Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives	DRIVES-IN001

To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

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Allen-Bradley Drives Technical Support

Online at...	By Email at...	By Telephone at...
www.ab.com/support/abdrives	support@drives.ra.rockwell.com	262-512-8176

Installation Instructions in Other Languages

English	This instruction sheet is available in multiple languages at http://rockwellautomation.com/literature. Select publication language and type “20A-IN009” in the search field.
Deutsch	Dieses Instruktionsblatt kann in mehreren Sprachen unter http://rockwellautomation.com/literature gelesen werden. Bitte Ihre Sprache anwählen und “20A-IN009” im Suchfeld eintippen.
Français	Ces instructions sont disponibles dans différentes langues à l’adresse suivante: http://rockwellautomation.com/literature. Sélectionner la langue puis taper << 20A-IN009 >> dans le champ de recherche.
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Chinese (simplified)	从以下网页可以获得本说明书的多种语言的版本： http://rockwellautomation.com/literature 。 请选择出版物的语言，并在搜索栏输入 “20A-IN009 印

Table of Contents

Catalog Number Explanation 4

Step 1 **Read the General Precautions** 4
Qualified Personnel 4
Personal Safety 5
Product Safety 5
EMC Instructions 7
CE Conformity 7
Low Voltage Directive (2006/95/EC) 7
EMC Directive (89/336/EEC) 7
General Notes 7
Essential Requirements for CE Compliance 8

Step 2 **Mount the Drive – Minimum Requirements** 9
Minimum Mounting Clearances 9
Maximum Surrounding Air Temperature 9
Dimensions 10

Step 3 **Wire the Drive – Wire Recommendations** 11
Terminal Block Specifications 12
Power & Ground Wiring 14
Drive, Fuse & Circuit Breaker Ratings 14
Disconnecting MOVs and Common Mode Capacitors 21

Step 4 **I/O Wiring** 27
I/O Terminal Positions 29
I/O Wiring Examples 29
Hardware Enable Circuitry (Enhanced Control Only) 31
Safe Off Board Option (Enhanced Control Only) 32
Encoder Interface Option (Enhanced Control Only) 33

Step 5 **Start-Up Check List** 34
Prepare For Drive Start-Up 34
Information About Start-Up Motor Tests 35

Appendix

First Powerup Menu Structure 36
Human Interface Module (HIM) Overview 37
Drive Status Indicators 41
Common I/O Programming Changes 42
Troubleshooting – Abbreviated Fault & Alarm Listing 43
Common Symptoms and Corrective Actions 45
Manually Clearing Faults 47
Parameter List 48

Catalog Number Explanation

Position Number

1-3	4	5-7	8	9	10	11	12	13	14	15	16
20A	B	2P2	A	3	A	Y	Y	N	N	C	0
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*

a

Drive	
Code	**Type**
20A	PowerFlex 70

b

Voltage Rating		
Code	**Voltage**	**Ph.**
B	240V ac	3
C	400V ac	3
D	480V ac	3
E	600V ac	3

c

ND Output Rating for Voltage Rating		
Examples:		
Code	**Amps**	**kW (Hp)**
2P2	2.2	0.37 (0.5)
022	22	5.5 (7.5)

d

Enclosure	
Code	**Enclosure**
A	Panel Mount - IP 20, NEMA/UL Type 1
C	Wall/Machine Mount = IP66, NEMA/UL Type 4X/12 for indoor use only
F	Flange Mount - Front Chassis = IP 20, NEMA/UL Type 1; Rear Heatsink = IP66, NEMA/UL Type 4X/12 for indoor/outdoor use
G	Wall/Machine Mount - IP54, NEMA/UL Type 12 ∗
L	Flange Mount with Conformal Coat
M	Panel Mount with Conformal Coat

∗ Only available on Frame E.

e

HIM	
Code	**Interface Module**
0	Blank Cover
3	Full Numeric LCD
5	Prog. Only LCD
8	Wireless Interface Module - IP66, NEMA/UL Type 4X/12 Only

f

Documentation	
Code	**Type**
A	Manual
N	No Manual

g

Brake IGBT	
Code	**w/Brake IGBT**
Y	Yes

h

Internal Brake Resistor	
Code	**w/Resistor**
Y	Yes
N	No

i

Emission Class	
Code	**Rating**
A	Filtered∗ A❊ & B Frames (Optional) C, D, & E Frames (Standard)
N	Not Filtered∗ A & B Frames (Optional) C, D, & E Frames

∗ 600V Frames A through D available only without filter (Cat. Code N). 600V Frame E available only with filter (Cat. Code A).

❊ Increases size to Frame B.

j

Comm Slot	
Code	**Version**
B	BACnet
C	ControlNet (Coax)
D	DeviceNet
E	EtherNet/IP
R	RIO
S	RS485 DF1
N	None

k

Control & I/O		
Code	**Control**	**Safe-Off**
N	Standard	N/A
C	Enhanced	No
G∗	Enhanced	Yes

∗ Not available as factory installed option for 600V ratings.

l

Feedback	
Code	**Feedback**
N	NA - Standard Control
0	No Feedback - Enhanced Control
1	5V/12V Encoder w/Enhanced Control

Step 1 Read the General Precautions

Qualified Personnel

ATTENTION: Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

Personal Safety

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC terminal of the Power Terminal Block and the -DC test point (refer to page 13 for location). The voltage must be zero.

ATTENTION: Risk of injury or equipment damage exists. DPI or SCANport host products must not be directly connected together via 1202 cables. Unpredictable behavior can result if two or more devices are connected in this manner.

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

Product Safety

ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Guarding Against Electrostatic Damage, publication 8000-4.5.2 or any other applicable ESD protection handbook.

ATTENTION: Configuring an analog input for 0-20 mA operation and driving it from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

ATTENTION: A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If an input device is used, operation must not exceed one cycle per minute or drive damage will occur.

ATTENTION: The "adjust freq" portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault; however, it can also cause either of the following two conditions to occur.

1. Fast positive changes in input voltage (more than a 10% increase within 6 minutes) can cause uncommanded positive speed changes; however an "OverSpeed Limit" fault will occur if the speed reaches [Max Speed] + [Overspeed Limit]. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive and, 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the "adjust freq" portion of the bus regulator function must be disabled (see parameters 161 and 162).
2. Actual deceleration times can be longer than commanded deceleration times; however, a "Decel Inhibit" fault is generated if the drive stops decelerating altogether. If this condition is unacceptable, the "adjust freq" portion of the bus regulator must be disabled (see parameters 161 and 162). In addition, installing a properly sized dynamic brake resistor will provide equal or better performance in most cases.

Note: These faults are not instantaneous and have shown test results that take between 2 and 12 seconds to occur.

Output Contactor Precaution

ATTENTION: To guard against drive damage when using output contactors, the following information must be read and understood. One or more output contactors may be installed between the drive and motor(s) for the purpose of disconnecting or isolating certain motors/loads. If a contactor is opened while the drive is operating, power will be removed from the respective motor, but the drive will continue to produce voltage at the output terminals. In addition, reconnecting a motor to an active drive (by closing the contactor) could produce excessive current that may cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor should be wired to a drive digital input that is programmed as "Enable." This will cause the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

EMC Instructions

CE Conformity(1)

Conformity with the Low Voltage (LV) Directive and Electromagnetic Compatibility (EMC) Directive has been demonstrated using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. PowerFlex Drives comply with the EN standards listed below when installed according to the User and Reference Manuals.

CE Declarations of Conformity are available online at:
www.ab.com/certification/ce/docs

Low Voltage Directive (2006/95/EC)

- EN50178 Electronic equipment for use in power installations.

EMC Directive (89/336/EEC)

- EN61800-3 Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods.

General Notes

- Some drives are equipped with an adhesive label on the top of the drive. If the adhesive label is removed from the top of the drive, the drive must be installed in an enclosure with side openings less than 12.5 mm (0.5 in) and top openings less than 1.0 mm (0.04 in) to maintain compliance with the LV Directive.
- The motor cable should be kept as short as possible in order to avoid electromagnetic emission as well as capacitive currents.
- Use of line filters in ungrounded systems is not recommended.
- PowerFlex drives may cause radio interference if used in a residential or domestic environment. The installer is required to take measures to prevent interference, in addition to the essential requirements for CE compliance listed below, if necessary.
- Conformity of the drive with CE EMC requirements does not guarantee an entire machine or installation complies with CE EMC requirements. Many factors can influence total machine/installation compliance.
- PowerFlex drives can generate conducted low frequency disturbances (harmonic emissions) on the AC supply system. More information regarding harmonic emissions can be found in the PowerFlex Reference Manual, publication PFLEX-RM004.

(1) CE Certification testing has not been completed for 600 Volt class drives.

Essential Requirements for CE Compliance

Conditions 1…6 listed below **must be** satisfied for PowerFlex drives to meet the requirements of **EN61800-3**.

1. Standard PowerFlex 70 CE compatible Drive.
2. Review important precautions/attention statements throughout this manual before installing drive.
3. Grounding as described in Chapter 1 of the User Manual, publication 20A-UM001.
4. Output power, control (I/O) and signal wiring must be braided, shielded cable with a coverage of 75% or better, metal conduit or equivalent attenuation.
5. All shielded cables should terminate with the proper shielded connector.
6. Conditions in Table A.

Table A PowerFlex 70 EN61800-3 EMC Compatibility

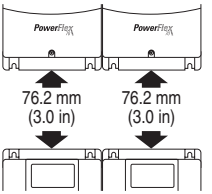
Frame(s)	Drive Description	Second Environment				First Environment Restricted Distribution
		Restrict Motor Cable to 40 m (131 ft)	Internal Filter Option	External Filter	Input Ferrite (1)	
A	Drive Only	✔		✔		See *PowerFlex Reference Manual*
	with any Comm Option	✔		✔		
	with Remote I/O	✔		✔	✔	
B	Drive Only	✔	✔			
	with any Comm Option	✔	✔			
	with Remote I/O	✔	✔		✔	
C, D, E	Drive Only	✔				
	with any Comm Option	✔				
	with Remote I/O	✔			✔	

(1) Input cables through a Ferrite Core (Frames A, B and C Fair-Rite #2643102002 or equivalent, Frames D and E Fair-Rite #2643251002 or equivalent).

Step 2 Mount the Drive – Minimum Requirements

Minimum Mounting Clearances

Specified vertical clearance requirements are intended to be from drive to drive. Other objects can occupy this space; however, airflow must not be reduced and inlet air temperature must not exceed the product specification.



Maximum Surrounding Air Temperature

Enclosure Rating	Temperature Range
Open Type, IP 20, NEMA/UL Type 1 & Flange Mount	0…50 °C (32…22 °F)
IP54, IP 66 & NEMA/UL Type 4X/12	0…40 °C (32…104 °F)

Important: Some drives are equipped with an adhesive label on the top of the chassis. Removing the adhesive label from the drive changes the NEMA/UL enclosure rating from Type 1 Enclosed to Open Type.

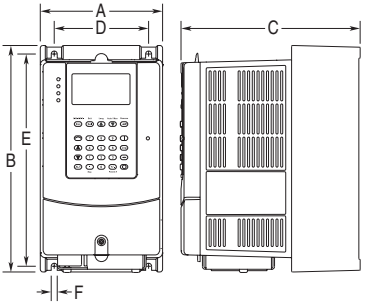
Dimensions

Table B PowerFlex 70 Frames

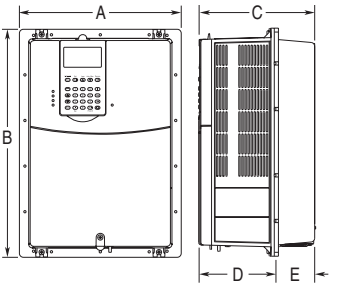
Output Power		Frame Size								
		208…240V AC Input			400…480V AC Input			600V AC Input		
kW ND (HD)	HP ND (HD)	Not (1) Filtered	(2) Filtered	IP66 (4X/12)	Not (1) Filtered	(2) Filtered	IP66 (4X/12)	Not (1) Filtered	(2) Filtered	IP66 (4X/12)
0.37 (0.25)	0.5 (0.33)	A	B	B	A	B	B	A	–	B
0.75 (0.55)	1 (0.75)	A	B	B	A	B	B	A	–	B
1.5 (1.1)	2 (1.5)	B	B	B	A	B	B	A	–	B
2.2 (1.5)	3 (2)	B	B	B	B	B	B	B	–	B
4 (3)	5 (3)	–	C	D	B	B	B	B	–	B
5.5 (4)	7.5 (5)	–	D	D	–	C	D	C	–	D
7.5 (5.5)	10 (7.5)	–	D	D	–	C	D	C	–	D
11 (7.5)	15 (10)	–	D	D	–	D	D	D	–	D
15 (11)	20 (15)	–	E	E	–	D	D	D	–	D
18.5 (15)	25 (20)	–	E	E	–	D	D	D	–	D
22 (18.5)	30 (25)	–	–	–	–	D	D	D	–	D
30 (22)	40 (30)	–	–	–	–	E	E	–	E	E
37 (30)	50 (40)	–	–	–	–	E	E	–	E	E

(1) Not Filtered indicated if Position 13 of the Catalog Number = N.
(2) Filtered indicated if Position 13 of the Catalog Number = A.

IP20/66 (NEMA/UL Type 1/4X/12)



Flange Mount



Frame	Dimension *Dimensions are in millimeters and (inches)* A	B	C	D	E	F	Weight (1) *kg (lb)*
	IP20 / NEMA Type 1						
A	122.4 (4.82)	225.7 (8.89)	179.8 (7.08)	94.2 (3.71)	211.6 (8.33)	5.8 (0.23)	2.71 (6.0)
B	171.7 (6.76)	234.6 (9.24)	179.8 (7.08)	122.7 (4.83)	220.2 (8.67)	5.8 (0.23)	3.60 (7.9)
C	185.0 (7.28)	300.0 (11.81)	179.8 (7.08)	137.6 (5.42)	285.6 (11.25)	5.8 (0.23)	6.89 (15.2)
D	219.9 (8.66)	350.0 (13.78)	179.8 (7.08)	169.0 (6.65)	335.6 (13.21)	5.8 (0.23)	9.25 (20.4)
E	280.3 (11.04)	555.8 (21.88)	207.1 (8.15)	200.0 (7.87)	491.0 (19.33)	6.9 (0.27)	18.60 (41.0)
	IP66 / NEMA Type 4X/12						
B	171.7 (6.76)	239.8 (9.44)	203.3 (8.00)	122.7 (4.83)	220.2 (8.67)	5.8 (0.23)	3.61 (8.0)
D	219.9 (8.66)	350.0 (13.78)	210.7 (8.29)	169.0 (6.65)	335.6 (13.21)	5.8 (0.23)	9.13 (20.1)
E	280.3 (11.04)	555.8 (21.88)	219.8 (8.65)	200.0 (7.87)	491.0 (19.33)	6.9 (0.27)	18.60 (41.0)
	Flange Mount						
A	156.0 (6.14)	225.8 (8.89)	178.6 (7.03)	123.0 (4.84)	55.6 (2.19)	–	2.71 (6.0)
B	205.2 (8.08)	234.6 (9.24)	178.6 (7.03)	123.0 (4.84)	55.6 (2.19)	–	3.60 (7.9)
C	219.0 (8.62)	300.0 (11.81)	178.6 (7.03)	123.0 (4.84)	55.6 (2.19)	–	6.89 (15.2)
D	248.4 (9.78)	350.0 (13.78)	178.6 (7.03)	123.0 (4.84)	55.6 (2.19)	–	9.25 (20.4)
E	280.3 (11.04)	555.8 (21.88)	207.1 (8.15)	117.2 (4.61)	89.9 (3.54)	–	18.60 (41.0)

(1) Weights include Human Interface Module (HIM).

Step 3 Wire the Drive – Wire Recommendations

Type		Wire Type(s)	Description	Min. Insulation Rating
Power (1)(2)	Standard	600V, 90 °C (194 °F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.	
Signal (1) (3) (4)	Standard Analog I/O	Belden 8760/9460 (or equiv.)	0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain.	300V, 75…90 °C (167…194 °F)
		Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 cond., shielded for remote pot only.	
Digital I/O (1) (3) (4)	Shielded	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	300V, 60 °C (140 °F)

(1) Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).
(2) The use of shielded wire for AC input power may not be necessary but is always recommended.
(3) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.
(4) I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

Input Power Conditioning

Certain events on the power system supplying a drive can cause component damage or shortened product life. These conditions are divided into 2 basic categories:

1. **All drives**
   - The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
   - The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.
   - The power source has frequent interruptions.
2. **5 HP or Less Drives (in addition to "1" above)**
   - The nearest supply transformer is larger than 100 kVA or the available short circuit (fault) current is greater than 100,000 A.
   - The impedance in front of the drive is less than 0.5%.

If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor. The impedance can be calculated using the information supplied in the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001.

Single-Phase Input Power

The PowerFlex 70 drive is typically used with a three-phase input supply. The drive has been listed by U.L. to operate on single-phase input power. Single-phase operation provides 50% of the three-phase rated current. Refer to Table F through Table H.

Generator Input Power

Contact Allen-Bradley Drives Technical Support for details on how to properly power a drive using generator power.

Terminal Block Specifications

Name	Frame	Description	Wire Size Range(1)		Torque	
			Maximum	Minimum	Maximum	Recommended
Power Terminal Block	A, B, C	Input power and motor connections	4.0 mm^2 (10 AWG)	0.3 mm^2 (22 AWG)	1.1 N•m (10 lb•in)	0.8 N•m (7 lb•in)
	D	Input power and motor connections	10.0 mm^2 (6 AWG)	0.8 mm^2 (18 AWG)	1.7 N•m (15 lb•in)	1.4 N•m (12 lb•in)
	E	Input power and motor connections	25.0 mm^2 (3 AWG)	2.5 mm^2 (14 AWG)	2.71 N•m (24 lb•in)	2.71 N•m (24 lb•in)
I/O Terminal Block	All	Signal & control connections	1.5 mm^2 (16 AWG)	0.05 mm^2 (30 AWG)	0.55 N•m (4.9 lb•in)	0.5 N•m (4.4 lb•in)
SHLD Terminal	All	Terminating point for wiring shields	—	—	1.6 N•m (14 lb•in)	1.6 N•m (14 lb•in)

(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

Figure 1 Frame A, B, C, D Power Terminal Block and DC Bus Test Points

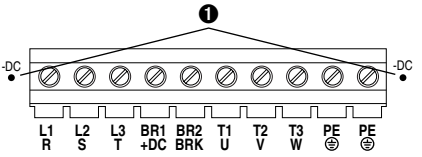
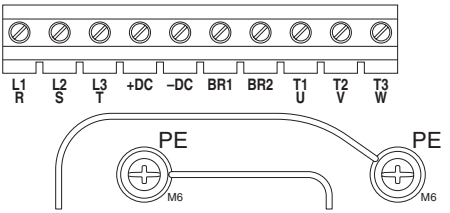
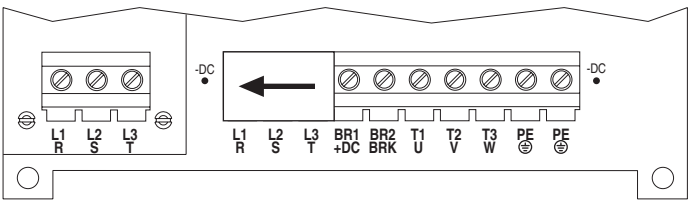


Figure 2 Frame E Power Terminal Block

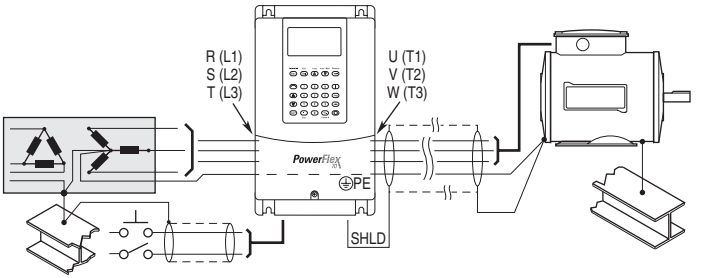


Terminal	Description	Notes
R	R (L1)	3-Phase AC Line Input Power For 1-Phase Input, connect to any two terminals.
S	S (L2)	
T	T (L3)	
BR1	DC Brake	DB Resistor Connection - **Important:** Do not connect both an internal and external DB resistor at the same time. This may violate the minimum allowed DB resistance and cause drive damage.
BR2	DC Brake	
U	U (T1)	To Motor
V	V (T2)	To Motor
W	W (T3)	To Motor
PE	PE Ground	
PE	PE Ground	
-DC	DC Bus (–)	❶ Test point on Frames A, B, C, and D located to the left or right of the Power Terminal Block. Frame E has a dedicated terminal.
+DC	DC Bus (+)	

Figure 3 Power Input Terminals on Frame B with Internal RFI Filter Option



Power & Ground Wiring



Drive, Fuse & Circuit Breaker Ratings

The tables on the following pages provide drive ratings (including continuous, 1 minute and 3 second) and recommended AC line input fuse and circuit breaker information. Both types of short circuit protection are acceptable for UL and IEC requirements. Sizes listed are the recommended sizes based on 40 °C and the U.S. N.E.C. Other country, state or local codes may require different ratings.

Fusing

If fuses are chosen as the desired protection method, refer to the recommended types listed below. If available amp ratings do not match the tables provided, the closest fuse rating that exceeds the drive rating should be chosen.

- IEC – BS88 (British Standard) Parts 1 & 2(1), EN60269-1, Parts 1 & 2, type gG or equivalent should be used.
- UL – UL Class CC, T, RK1 or J should be used.

Circuit Breakers

The “non-fuse” listings in the following tables include both circuit breakers (inverse time or instantaneous trip) and 140M Self-Protecting Motor Starters. **If one of these is chosen as the desired protection method**, the following requirements apply.

- IEC and UL – Both types of devices are acceptable for IEC and UL installations.

(1) Typical designations include, but may not be limited to the following; Parts 1 & 2: AC, AD, BC, BD, CD, DD, ED, EFS, EF, FF, FG, GF, GG, GH.

Table C 208/240 Volt AC Three-Phase Input Drive Ratings and Input Protection Devices (See page 17 for Notes)

Drive Catalog Number	Frame[1]	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Protector with Adjustable Current Range[7] [8]			
		ND	HD	Amps	kVA	Cont.	1 Min.	3 Sec.	Min.[2]	Max.[3]	Min.[2]	Max.[3]	Max.[5]	Max.[5]	Available Catalog Numbers[9]			
208 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.9	1.1	2.5	2.7	3.7	6	6	6	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AB4P2	A	1	0.75	5.6	2	4.8	5.5	7.4	10	10	10	17.5	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	10	3.6	7.8	10.3	13.8	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	14	5.1	11	12.1	16.5	20	25	20	40	40	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	16	5.8	17.5	19.2	26.6	20	35	20	70	70	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AB022	D	7.5	5	23.3	8.3	25.3	27.8	37.9	30	50	30	100	100	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	29.8	10.7	32.2	37.9	50.6	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	39.8	14.3	43	55.5	74	60	100	60	175	175	70	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	57.5	20.7	62.1	72.4	96.6	80	125	80	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	72.3	26.0	78.2	93.1	124	90	175	90	300	300	100	–	–	–	140-CMN-9000
240 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.5	1.1	2.2	2.4	3.3	3	4.5	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AB4P2	A	1	0.75	4.8	2	4.2	4.8	6.4	6	9	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	8.7	3.6	6.8	9	12	15	15	15	25	25	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	12.2	5.1	9.6	10.6	14.4	20	20	20	35	35	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	13.9	5.8	15.3	17.4	23.2	20	30	20	60	60	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB022	D	7.5	5	19.9	8.3	22	24.4	33	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	25.7	10.7	28	33	44	35	60	35	110	110	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	38.7	16.1	42	46.2	63	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	49.8	20.7	54	63	84	60	100	60	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	64.5	26.8	70	81	108	90	150	90	275	275	100	–	–	–	140-CMN-9000

Table D 400/480 Volt AC Three-Phase Input Drive Ratings and Input Protection Devices (See page 17 for Notes).

Drive Catalog Number	Frame[1]	kW *(400V)* HP *(480V)* Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Protector with Adjustable Current Range[7] [8]			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.*[2]	*Max.*[3]	*Min.*[2]	*Max.*[3]	*Max.*[5]	*Max.*[5]	*Available Catalog Numbers*[9]			
400 Volt AC Input																		
20AC1P3	A	0.37	0.25	1.6	1.1	1.3	1.4	1.9	3	3	3	5	15	3	140M-C2E-B16	–	–	–
20AC2P1	A	0.75	0.55	2.5	1.8	2.1	2.4	3.2	4	6	4	8	15	7	140M-C2E-B25	140M-D8E-B25	–	–
20AC3P5	A	1.5	1.1	4.3	3	3.5	4.5	6	6	6	6	12	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AC5P0	B	2.2	1.5	6.5	4.5	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AC8P7	B	4	3	11.3	7.8	8.7	9.9	13.2	15	17.5	15	30	30	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC011	C	5.5	4	10.5	7.6	11.5	13	17.4	15	25	15	45	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC015	C	7.5	5.5	145.1	10.4	15.4	17.2	23.1	20	30	20	60	60	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC022	D	11	7.5	21.9	15.2	22	24.2	33	30	45	30	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AC030	D	15	11	30.3	21	30	33	45	40	60	40	120	120	50	–	–	140M-F8E-C32	140-CMN-4000
20AC037	D	18.5	15	35	24.3	37	45	60	50	80	50	125	140	50	–	–	140M-F8E-C45	140-CMN-4000
20AC043	D	22	18.5	40.7	28.2	43	56	74	60	90	60	150	160	70	–	–	–	140-CMN-6300
20AC060	E	30	22	56.8	39.3	60	66	90	80	125	80	225	240	80	–	–	–	140-CMN-6300
20AC072	E	37	30	68.9	47.8	72	90	120	90	150	90	250	280	100	–	–	–	140-CMN-9000
480 Volt AC Input																		
20AD1P1	A	0.5	0.33	1.3	1.1	1.1	1.2	1.6	3	3	3	4	15	3	140M-C2E-B16	–	–	–
20AD2P1	A	1	0.75	2.4	2	2.1	2.4	3.2	3	6	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AD3P4	A	2	1.5	3.8	3.2	3.4	4.5	6	6	6	6	12	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AD5P0	B	3	2	5.6	4.7	5	5.5	7.5	10	10	10	20	20	15	140M-C2E-B63	140M-D8E-B63	–	–
20AD8P0	B	5	3	9.8	8.4	8	8.8	12	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AD011	C	7.5	5	9.4	7.9	11	12.1	16.5	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD014	C	10	7.5	12.4	10.4	14	16.5	22	20	30	20	50	50	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD022	D	15	10	19.9	16.6	22	24.2	33	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	–
20AD027	D	20	15	24.8	20.6	27	33	44	35	60	35	100	100	50	–	–	140M-F8E-C32	140-CMN-2500
20AD034	D	25	20	31.2	25.9	34	40.5	54	40	70	40	125	125	50	–	–	140M-F8E-C45	140-CMN-4000
20AD040	D	30	25	36.7	30.5	40	51	68	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-4000
20AD052	E	40	30	47.7	39.7	52	60	80	60	110	60	200	200	70	–	–	–	140-CMN-6300
20AD065	E	50	40	59.6	49.6	65	78	104	80	125	80	250	250	100	–	–	–	140-CMN-9000

Table E 600 Volt AC Three-Phase Input Drive Ratings and Input Protection Devices

Drive Catalog Number	Frame(1)	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker(4)	Motor Circuit Protector(6)	140M Motor Protector with Adjustable Current Range(7) (8)			
		ND	HD	Amps	kVA	Cont.	1 Min.	3 Sec.	Min.(2)	Max.(3)	Min.(2)	Max.(3)	Max.(5)	Max.(5)	Available Catalog Numbers(9)			
600 Volt AC Input																		
20AE0P9	A	0.5	0.33	1.3	1.3	0.9	1.1	1.4	3	3	3	3.5	15	3	140M-C2E-B16	–	–	–
20AE1P7	A	1	0.75	1.9	2	1.7	2	2.6	3	6	3	6	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AE2P7	A	2	1.5	3	3.1	2.7	3.6	4.8	4	6	4	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AE3P9	B	3	2	4.4	4.5	3.9	4.3	5.9	6	8	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AE6P1	B	5	3	7.5	7.8	6.1	6.7	9.2	10	12	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE9P0	C	7.5	5	7.7	8	9	9.9	13.5	10	20	10	35	35	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE011	C	10	7.5	9.8	10.1	11	13.5	18	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AE017	D	15	10	15.3	15.9	17	18.7	25.5	20	35	20	60	60	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AE022	D	20	15	20	20.8	22	25.5	34	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AE027	D	25	20	24.8	25.7	27	33	44	35	60	35	100	100	50	–	–	140M-F8E-C25	140-CMN-2500
20AE032	D	30	25	29.4	30.5	32	40.5	54	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AE041	E	40	30	37.6	39.1	41	48	64	50	90	50	150	150	100	–	–	140M-F8E-C45	140-CMN-4000
20AE052	E	50	40	47.7	49.6	52	61.5	82	60	110	60	200	200	100	–	–	–	140-CMN-6300

(1) For IP 66 (NEMA/UL Type 4X/12) enclosures, drives listed as Frame A increase to Frame B and drives listed as Frame C increase to Frame D.
(2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.
(3) Maximum protection device size is the highest rated device that supplies drive protection. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
(4) Circuit Breaker - inverse time breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
(5) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.
(6) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
(7) Bulletin 140M with adjustable current range should have the current trip set to the minimum range that the device will not trip.
(8) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600Y/347. Not UL listed for use on 480V or 600V Delta/Delta systems in single motor applications.
(9) The AIC ratings of the Bulletin 140M Motor Protector may vary. See publication 140M-SG001B-EN-P.

Table F 208/240 Volt AC Single-Phase Input Drive Ratings and Input Protection Devices (See page 20 for Notes)

Drive Catalog Number	Frame[1]	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Protector with Adjustable Current Range[7] [8]			
		ND	HD	Amps	kVA	Cont.	1 Min.	3 Sec.	Min.[2]	Max.[3]	Min.[2]	Max.[3]	Max.[5]	Max.[5]	Available Catalog Numbers[9]			
208 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.9	0.6	1.3	1.6	1.9	6	6	6	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AB4P2	A	1	0.75	5.6	1	2.4	2.8	3.7	10	10	10	17.5	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	10	1.8	3.9	5.2	6.9	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	14	2.6	5.5	6.1	8.3	20	25	20	40	40	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	16	2.9	8.6	9.6	13.3	20	35	20	70	70	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AB022	D	7.5	5	23.3	4.2	12.7	13.9	19.0	30	50	30	100	100	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	29.8	5.4	16.1	19	25.3	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	39.8	7.2	21.5	27.8	37	60	100	60	175	175	70	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	57.5	10.4	31.1	36.2	48.3	80	125	80	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	72.3	13.0	39.1	46.6	62	90	175	90	300	300	100	–	–	–	140-CMN-9000
240 Volt AC Input																		
20AB2P2	A	0.5	0.33	2.5	0.6	1.1	1.2	1.7	3	4.5	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AB4P2	A	1	0.75	4.8	1	2.1	2.4	3.2	6	9	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AB6P8	B	2	1.5	8.7	1.8	3.4	4.5	6	15	15	15	25	25	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AB9P6	B	3	2	12.2	2.6	4.8	5.3	7.2	20	20	20	35	35	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB015	C	5	3	13.9	2.9	7.7	8.7	11.6	20	30	20	60	60	30	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AB022	D	7.5	5	19.9	4.2	11	12.2	16.5	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AB028	D	10	7.5	25.7	5.4	14	16.5	22	35	60	35	110	110	50	–	–	140M-F8E-C32	140-CMN-4000
20AB042	D	15	10	38.7	8.1	21	23.1	31.5	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-6300
20AB054	E	20	15	49.8	10.4	27	31.5	42	60	100	60	200	200	100	–	–	–	140-CMN-6300
20AB070	E	25	20	64.5	13.4	35	40.5	54	90	150	90	275	275	100	–	–	–	140-CMN-9000

Table G 400/480 Volt AC Single-Phase Input Drive Ratings and Input Protection Devices (See page 20 for Notes).

Drive Catalog Number	Frame[1]	kW *(400V)* HP *(480V)* Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker[4]	Motor Circuit Protector[6]	140M Motor Protector with Adjustable Current Range[7] [8]			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.*[2]	*Max.*[3]	*Min.*[2]	*Max.*[3]	*Max.*[5]	*Max.*[5]	*Available Catalog Numbers*[9]			
400 Volt AC Input																		
20AC1P3	A	0.37	0.25	1.6	0.6	0.7	0.7	1.0	3	3	3	5	15	3	140M-C2E-B16	–	–	–
20AC2P1	A	0.75	0.55	2.5	0.9	1.1	1.2	1.6	4	6	4	8	15	7	140M-C2E-B25	140M-D8E-B25	–	–
20AC3P5	A	1.5	1.1	4.3	1.5	1.8	2.3	3	6	6	6	12	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AC5P0	B	2.2	1.5	6.5	2.3	2.5	2.8	3.8	10	10	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AC8P7	B	4	3	11.3	3.9	4.4	5.0	6.6	15	17.5	15	30	30	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC011	C	5.5	4	11	3.8	5.8	6.5	8.7	15	25	15	45	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC015	C	7.5	5.5	15.1	5.2	7.7	8.6	11.6	20	30	20	60	60	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AC022	D	11	7.5	21.9	7.6	11	12.1	16.5	30	45	30	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AC030	D	15	11	30.3	10.5	15	16.5	22.5	40	60	40	120	120	50	–	–	140M-F8E-C32	140-CMN-4000
20AC037	D	18.5	15	35	12.2	18.5	22.5	30	50	80	50	125	140	50	–	–	140M-F8E-C45	140-CMN-4000
20AC043	D	22	18.5	40.7	14.1	21.5	28	37	60	90	60	150	160	70	–	–	–	140-CMN-6300
20AC060	E	30	22	56.8	19.7	30	33	45	80	125	80	225	240	80	–	–	–	140-CMN-6300
20AC072	E	37	30	68.9	23.9	36	45	60	90	150	90	250	280	100	–	–	–	140-CMN-9000
480 Volt AC Input																		
20AD1P1	A	0.5	0.33	1.3	0.6	0.6	0.6	0.8	3	3	3	4	15	3	140M-C2E-B16	–	–	–
20AD2P1	A	1	0.75	2.4	1	1.1	1.2	1.6	3	6	3	8	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AD3P4	A	2	1.5	3.8	1.6	1.7	2.3	3	6	6	6	12	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AD5P0	B	3	2	5.6	2.4	2.5	2.6	3.8	10	10	10	20	20	15	140M-C2E-B63	140M-D8E-B63	–	–
20AD8P0	B	5	3	9.8	4.2	4	4.4	6	15	15	15	30	30	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AD011	C	7.5	5	9.5	4	5.5	6.1	8.3	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD014	C	10	7.5	12.5	5.2	7	8.3	11	20	30	20	50	50	20	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AD022	D	15	10	19.9	8.3	11	12.1	16.5	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	–
20AD027	D	20	15	24.8	10.3	13.5	16.5	22	35	60	35	100	100	50	–	–	140M-F8E-C32	140-CMN-2500
20AD034	D	25	20	31.2	13	17	20.3	27	40	70	40	125	125	50	–	–	140M-F8E-C45	140-CMN-4000
20AD040	D	30	25	36.7	19.9	20	25.5	34	50	90	50	150	150	50	–	–	140M-F8E-C45	140-CMN-4000
20AD052	E	40	30	47.7	12.8	26	30	40	60	110	60	200	200	70	–	–	–	140-CMN-6300
20AD065	E	50	40	59.6	24.8	32.5	39	52	80	125	80	250	250	100	–	–	–	140-CMN-9000

Table H 600 Volt AC Single-Phase Input Drive Ratings and Input Protection Devices

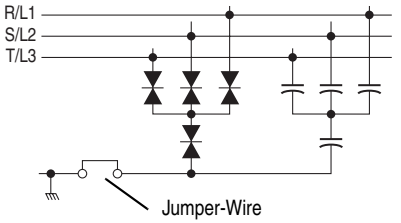
Drive Catalog Number	Frame(1)	HP Rating		Input Ratings		Output Amps			Dual Element Time Delay Fuse		Non-Time Delay Fuse		Circuit Breaker(4)	Motor Circuit Protector(6)	140M Motor Protector with Adjustable Current Range(7) (8)			
		ND	*HD*	*Amps*	*kVA*	*Cont.*	*1 Min.*	*3 Sec.*	*Min.(2)*	*Max.(3)*	*Min.(2)*	*Max.(3)*	*Max.(5)*	*Max.(5)*	*Available Catalog Numbers(9)*			
600 Volt AC Input																		
20AE0P9	A	0.5	0.33	1.3	0.7	0.5	0.6	0.7	3	3	3	3.5	15	3	140M-C2E-B16	–	–	–
20AE1P7	A	1	0.75	1.9	1	0.9	1	1.3	3	6	3	6	15	3	140M-C2E-B25	140M-D8E-B25	–	–
20AE2P7	A	2	1.5	3	1.6	1.4	1.8	2.4	4	6	4	10	15	7	140M-C2E-B40	140M-D8E-B40	–	–
20AE3P9	B	3	2	4.4	2.3	2	2.2	3	6	8	6	15	15	7	140M-C2E-B63	140M-D8E-B63	–	–
20AE6P1	B	5	3	7.5	3.9	3.1	3.4	4.6	10	12	10	20	20	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE9P0	C	7.5	5	7.7	4	4.5	5	6.8	10	20	10	35	35	15	140M-C2E-C10	140M-D8E-C10	140M-F8E-C10	–
20AE011	C	10	7.5	9.8	5.1	5.5	6.8	9	15	20	15	40	40	15	140M-C2E-C16	140M-D8E-C16	140M-F8E-C16	–
20AE017	D	15	10	15.3	8	8.5	9.4	12.8	20	35	20	60	60	30	140M-C2E-C20	140M-D8E-C20	140M-F8E-C20	–
20AE022	D	20	15	20	10.4	11	12.8	17	25	45	25	80	80	30	140M-C2E-C25	140M-D8E-C25	140M-F8E-C25	140-CMN-2500
20AE027	D	25	20	24.8	12.9	13.5	16.5	22	35	60	35	100	100	50	–	–	140M-F8E-C25	140-CMN-2500
20AE032	D	30	25	29.4	15.3	16	20.3	27	40	70	40	125	125	50	–	–	140M-F8E-C32	140-CMN-4000
20AE041	E	40	30	37.6	19.6	20.5	24	32	50	90	50	150	150	100	–	–	140M-F8E-C45	140-CMN-4000
20AE052	E	50	40	47.7	24.8	26	30.8	41	60	110	60	200	200	100	–	–	–	140-CMN-6300

(1) For IP 66 (NEMA/UL Type 4X/12) enclosures, drives listed as Frame A increase to Frame B and drives listed as Frame C increase to Frame D.
(2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.
(3) Maximum protection device size is the highest rated device that supplies drive protection. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
(4) Circuit Breaker - inverse time breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
(5) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.
(6) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC, minimum size is 125% of motor FLA. Ratings shown are maximum.
(7) Bulletin 140M with adjustable current range should have the current trip set to the minimum range that the device will not trip.
(8) Manual Self-Protected (Type E) Combination Motor Controller, UL listed for 208 Wye or Delta, 240 Wye or Delta, 480Y/277 or 600Y/347. Not UL listed for use on 480V or 600V Delta/Delta systems in single motor applications.
(9) The AIC ratings of the Bulletin 140M Motor Protector may vary. See publication 140M-SG001B-EN-P.

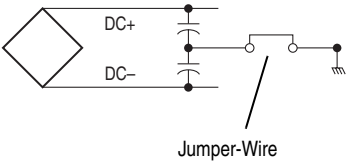
Disconnecting MOVs and Common Mode Capacitors

The PowerFlex 70 drive contains protective MOVs and Common Mode Capacitors referenced to ground (see below). To guard against unstable operation and/or damage, the drive must be properly configured as shown in Table I on page 22.

MOV and AC EMI Capacitor Phase to Ground



Common Mode Capacitor to Ground



Important: All PowerFlex 70 240, 480 & 600V AC input drives **are shipped without the DC bus common mode capacitors referenced to ground**. Specific drive catalog numbers are listed below:

Voltage	Cat. No.
240	20AB…
480	20AD…
600	20AE…

See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for information on ungrounded systems.

Before proceeding, ensure that all power to the drive has been removed.

ATTENTION: Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should perform maintenance/repair of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the +DC & –DC terminals of the Power Terminal Block (refer to the User Manual for location). The voltage must be zero.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Table I Recommended Power Jumper Configurations

Power Source Type (1)	MOV/Input Filter Caps (2)	DC Bus Common Mode Caps	Benefits Of Correct Configuration on Power Source Type
Unknown	Connected	Disconnected	See Solid & Non-Solid Ground points below
Solid Ground • AC fed, solidly grounded • DC fed from passive rectifier which has an AC source and solid ground	Connected	Connected	• UL compliance, • Reduced electrical noise, • Most stable operation, • EMC compliance, • Reduced voltage stress on components and motor bearings
Non-Solid Ground • AC fed ungrounded • Impedance grounded • High resistive ground • B phase ground • Regenerative unit such as common DC bus supply & brake • DC fed from an active converter	Disconnected	Disconnected	• Helps avoid severe equipment damage when ground fault occurs

(1) It is highly recommended to accurately determine the power source type and then configure appropriately.

(2) When MOVs are disconnected, the power system must have its own transient protection to ensure known and controlled voltages.

To connect or disconnect these devices, refer to pages 23 through 26.

Important: Common mode capacitors are required to conform with the EMC directive. Removing these devices will withdraw the associated directive.

In addition, on an ungrounded distribution system where the line-to-ground voltages on any phase could exceed 125% of the nominal line-to-line voltage, an isolation transformer should be installed. See Wiring and Grounding Guidelines for PWM AC Drives, publication DRIVES-IN001 for more information on impedance grounded and ungrounded systems.

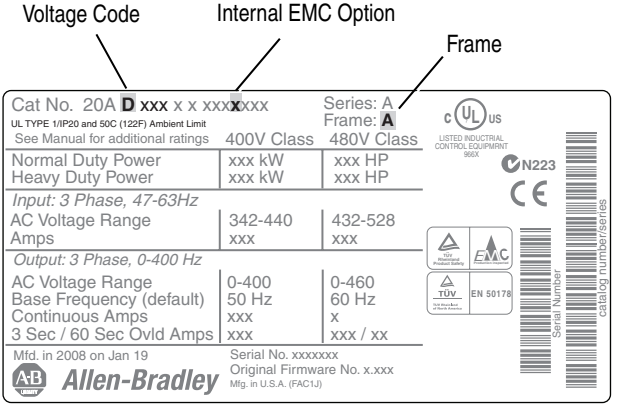
Jumper Installation, Removal and Storage

PowerFlex 70 drives utilize plug-in style jumpers. Most drives will have a jumper storage area inside the front cover. Extra jumpers or jumpers that have been removed should be stored in this location for use at a later time.

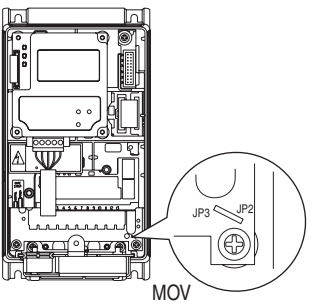
In some cases a protective cover may be present over the jumper pins that extend from the board. If present, simply remove the protective cover, install (or remove) jumper and replace cover.

Drive Identification

Refer to the drive nameplate and locate the "Voltage Code," "Frame" and "Internal EMC Option" (Frame B drives). Use this information to locate the proper procedure in the following tables.

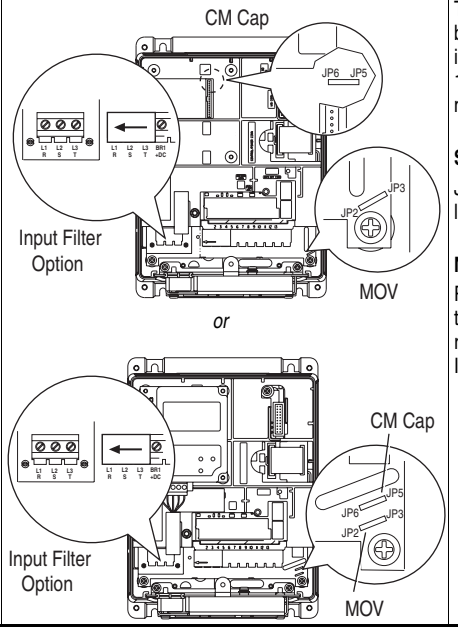


Jumper Settings and Locations

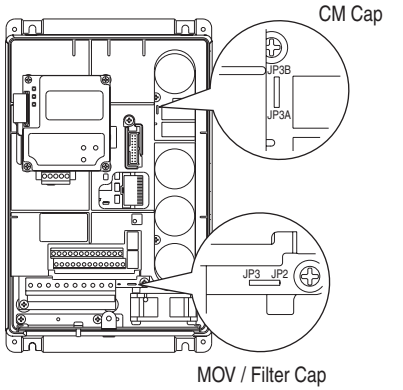
Frame	Voltage Code	Factory Default Jumper Settings		Power Source Type
		MOV/Input Filter Caps	DC Bus Common Mode Caps	
A	B C D E	JP2/JP3 Installed	Not Applicable	**Solid Ground** Insert jumper at the "JP2/JP3" location. **Non-Solid Ground** Remove the jumper at "JP2/JP3."
				

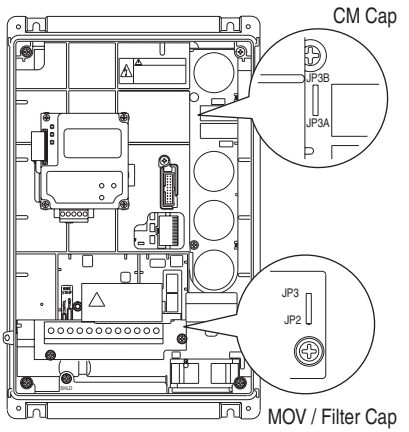
<table>
<tr><th rowspan="2">Frame</th><th rowspan="2">Voltage Code</th><th colspan="2">Factory Default Jumper Settings</th><th rowspan="2">Power Source Type</th></tr>
<tr><th>MOV/Input Filter Caps</th><th>DC Bus Common Mode Caps</th></tr>
<tr><td rowspan="3">B</td><td>B
D
E</td><td>JP2/JP3
Installed</td><td>JP5/JP6
Not Installed</td><td rowspan="3">Important: The Internal EMC Filter (input filter) is a factory installed option on Frame B drives. If the option is installed, the drive cannot be used on a non-solid ground power source.
To verify: an extra “R, S, T” terminal block will be present if the option is installed (as shown). Additionally, the 13th character of the nameplate catalog number will be an “A” (see page 23).

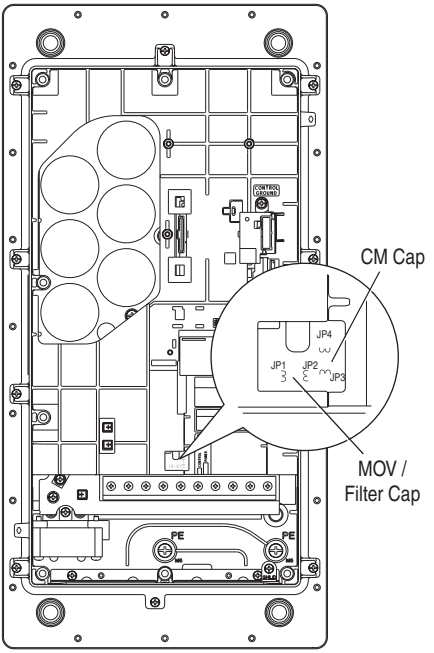
Solid Ground
Jumpers should be installed at both locations (JP2/JP3 and JP5/JP6).

Non-Solid Ground
Remove the jumper at “JP2/JP3.” Verify that the jumper at “JP5/JP6” is also removed. In addition, verify that the Input Filter option is not installed.</td></tr>
<tr><td>C</td><td>JP2/JP3
Installed</td><td>JP5/JP6
Installed</td></tr>
<tr><td colspan="3"> 
</td></tr>
</table>

<table>
<tr><th rowspan="2">Frame</th><th rowspan="2">Voltage Code</th><th colspan="2">Factory Default Jumper Settings</th><th rowspan="2">Power Source Type</th></tr>
<tr><th>MOV/Input Filter Caps</th><th>DC Bus Common Mode Caps</th></tr>
<tr><td rowspan="3">C</td><td>B
D
E</td><td>JP2/JP3
Installed</td><td>JP3A/JP3B
Not Installed</td><td rowspan="3">Solid Ground
Jumpers should be installed at both locations (JP2/JP3 and JP3A/JP3B).

Non-Solid Ground
Remove the jumper at “JP2/JP3.” Verify that the jumper at “JP3A/JP3B” is also removed.</td></tr>
<tr><td>C</td><td>JP2/JP3
Installed</td><td>JP3A/JP3B
Installed</td></tr>
<tr><td colspan="3"> 
</td></tr>
<tr><td rowspan="3">D</td><td>B
D
E</td><td>JP2/JP3
Installed</td><td>JP3A/JP3B
Not Installed</td><td rowspan="3">Solid Ground
Jumpers should be installed at both locations (JP2/JP3 and JP3A/JP3B).

Non-Solid Ground
Remove the jumper at “JP2/JP3.” Verify that the jumper at “JP3A/JP3B” is also removed.</td></tr>
<tr><td>C</td><td>JP2/JP3
Installed</td><td>JP3A/JP3B
Installed</td></tr>
<tr><td colspan="3"> 
</td></tr>
</table>

Frame	Voltage Code	Factory Default Jumper Settings		Power Source Type
		MOV/Input Filter Caps	DC Bus Common Mode Caps	
E	B D E	JP1/JP2 Installed	JP3/JP4 Not Installed	**Solid Ground** Jumpers should be installed at both locations (JP1/JP2 and JP3/JP4). **Non-Solid Ground** Remove the jumper at "JP1/JP2." Verify that the jumper at "JP3/JP4" is also removed.
	C	JP1/JP2 Installed	JP3/JP4 Installed	
				

Step 4 I/O Wiring

Important points to remember about I/O wiring:

- Use copper wire only. Wire gauge requirements and recommendations are based on 75 °C. Do not reduce wire gauge when using higher temperature wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).

Important: I/O terminals labeled "(–)" Digital In Common or "Common" are not connected to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

Table J I/O Terminal Designations – Standard and Enhanced Control

No.	Signal	Factory Default	Description	Related Param.
1	Digital In 1	Stop – CF (CF = Clear Fault)	11.2 mA @ 24V DC 19.2V minimum on state 3.2V maximum off state **Important:** Use only 24V DC, not suitable for 115V AC circuitry. Inputs can be wired as sink or source.	361 - 366
2	Digital In 2	Start		
3	Digital In 3	Auto/Man		
4	Digital In 4	Speed Sel 1		
5	Digital In 5	Speed Sel 2		
6	Digital In 6	Speed Sel 3		
7	24V Common	–	Drive supplied power for Digital In1…6 inputs only. Not intended for use on circuits outside of the drive. 150 mA maximum load.	
8	Digital In Common	–		
9	+24V DC	–		
10	+10V DC Pot Reference	–	2 k ohm minimum load.	
11	Digital Out 1 – N.O.(1)	NOT Fault	Max Resistive Load: 250V AC / 30V DC, 50VA / 60 W Max Inductive Load: 250V AC / 30V DC, 25 VA / 30 W Minimum DC Load: 10 µA, 10 mV DC	380 - 387
12	Digital Out 1 Common			
13	Digital Out 1 – N.C.(1)	Fault		
14	Analog In 1 (– Volts)	(2) TB Man Ref Voltage – Reads value at 14 & 15	Non-isolated, 0 to +10V, 10 bit, 100k ohm input impedance.(3)	320 - 327
15	Analog In 1 (+ Volts)			
16	Analog In 1 (– Current)		Non-isolated, 0-20 mA, 10 bit, 100 ohm input impedance.(3)	
17	Analog In 1 (+ Current)			
18	Analog In 2 (– Volts)	(2) Speed Ref A Voltage – Reads value at 18 & 19	Isolated, bipolar, differential, 0 to +10V unipolar (10 bit) or ±10V bipolar (10 bit & sign), 100k ohm input impedance.(4)	
19	Analog In 2 (+ Volts)			
20	Analog In 2 (– Current)		Isolated, 0-20 mA, 10 bit & sign, 100 ohm input impedance.(4)	
21	Analog In 2 (+ Current)			
22	10V Pot Common Analog Out (– Volts) Analog Out (– Current)	(2) Output Freq	0 to +10V, 10 bit, 10k ohm (2k ohm minimum) load. 0 to 20 mA, 10 bit, 400 ohm maximum load.(5) Referenced to chassis ground. Common if internal 10V supply (terminal 10) is used.	340 - 344
23	Analog Out (+ Volts) Analog Out (+ Current)			
24	Digital Out 2 – N.O.(1)	Run	See description at No.s 11…13.	380 - 387
25	Digital Out 2 Common			
26	Digital Out 2 – N.C.(1)	NOT Run		

(1) Contacts shown in unpowered state. Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and deenergize (drop out) when fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will deenergize when condition is removed.

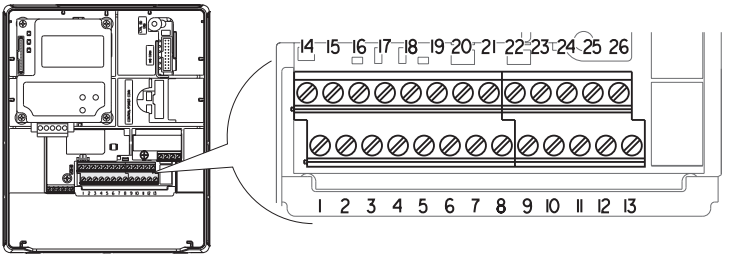
(2) These inputs/outputs are dependent on a number of parameters. See “Related Parameters.”

(3) Differential Isolation - External source must be less than 10V with respect to PE.

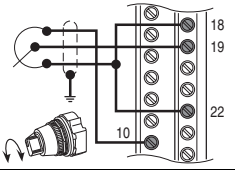
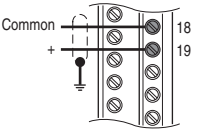
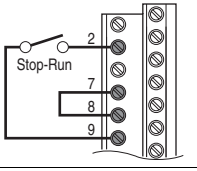
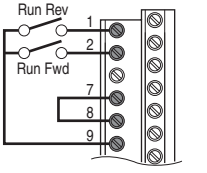
(4) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

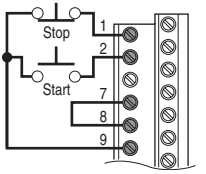
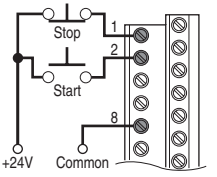
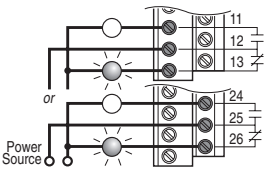
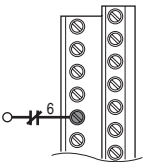
(5) Analog output current is only available with Enhanced Control drives.

I/O Terminal Positions



I/O Wiring Examples

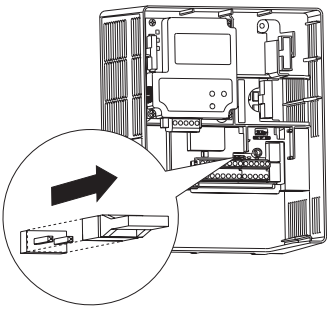
Input/Output	Connection Example	Required Parameter Settings
Potentiometer Unipolar Speed Reference 10k Ohm Pot. Recommended (2k Ohm minimum)		Select Speed Reference source: Param. 090 = 2 “Analog In 2” Adjust Scaling: Param. 091, 092, 322, 323 Check Results: Param. 017
Analog Input Unipolar Speed Reference 0 to +10V Input		Default Speed Reference source: Param. 090 = 2 “Analog In 2” Adjust Scaling: Param. 091, 092, 325, 326 Check Results: Param. 017
2 Wire(1) Control Non-Reversing	Internal Supply 	Disable Digital Input 1: Param. 361 = 0 “Not Used” Set Digital Input 2: Param. 362 = 7 “Run”
2 Wire(1) Control Reversing	Internal Supply 	Set Digital Input 1: Param. 361 = 9 “Run Reverse” Set Digital Input 2: Param. 362 = 8 “Run Forward”

Input/Output	Connection Example	Required Parameter Settings
3 Wire(1) Control	Internal Supply 	Use factory default parameter settings. Digital Input 1: Param. 361 = 4 “Stop – CF” Digital Input 2: Param. 362 = 5 “Start”
3 Wire(1) Control	External Supply 	Use factory default parameter settings. Digital Input 1: Param. 361 = 4 “Stop – CF” Digital Input 2: Param. 362 = 5 “Start”
Digital Output Form C Relays Energized in Normal State.		Select Source: Use factory default parameter settings. Digital Out1 Sel: Param. 380 = 1 “Fault” Digital Out2 Sel: Param. 384 = 4 “Run”
Enable Input Shown in enabled state.		Standard Control Param. 366 = 1 “Enable” Enhanced Control Param. 366 = 1 “Enable” For dedicated hardware Enable: Remove Enable Jumper (see page 31)

(1) Digital inputs can be wired for 2 Wire or 3 Wire Start/Stop control. Three Wire control requires separate Start and Stop signals. Two Wire control requires only one input signal configured Run-Hi/Stop-Lo.

Hardware Enable Circuitry (Enhanced Control Only)

By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without* software interpretation, a hardware enable configuration can be utilized. This is done by removing the enable jumper (ENBL JMP) and wiring the enable input to “Digital In 6” (see below).

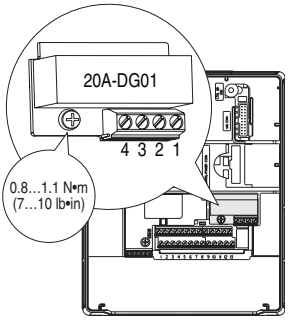


1.Remove drive cover.

2.Locate and remove the Enable Jumper on the Main Control Board (see diagram).

3.Wire Enable to “Digital In 6” (see Table J).

Safe Off Board Option (Enhanced Control Only)



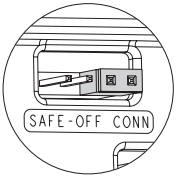
The optional PowerFlex Safe-Off board, when used with suitable safety components, provides protection according to EN 954-1:1997; Category 3 for safe off and protection against restart. The PowerFlex safe off option is just one safety control system. All components in the system must be chosen and applied correctly, to achieve the desired level of operator safeguarding.

Important: The drive ships with the hardware enable jumper (ENBL JMP) installed. This jumper must be removed when using the DriveGuard® Safe-Off option. Failure to remove the jumper will cause the drive to fault when a start command is issued.

Table K Terminal Description

No.	Signal	Description
1	Monitor - N.C.	Normally closed contacts for monitoring relay status. Maximum Resistive Load: 250V AC / 30V DC / 50 VA / 60 W Maximum Inductive Load: 250V AC / 30V DC / 25 VA / 30 W
2	Common - N.C.	
3	+24V DC	Connections for user supplied power to energize coil.
4	24V Common	

For detailed information on installing and wiring a safety relay system, refer to the DriveGuard Safe-Off Option (Series B) for PowerFlex 40P and PowerFlex 70 AC Drives User Manual, publication PFLEX-UM003.



Important: If the Safe-Off board is removed from the drive, pins 3 and 4 of the Safe-Off Connector must be jumpered for the drive to run. If the Safe-Off board or the jumper is not installed, and the drive is commanded to run, an F111 “Enable Hardware” fault will occur.

Encoder Interface Option (Enhanced Control Only)

The optional PowerFlex Encoder Interface can source 5 or 12 volt power and accept 5 or 12 volt single ended differential inputs. Factory default setting is 12 volts.

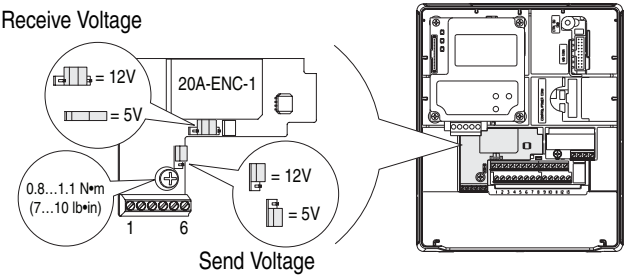
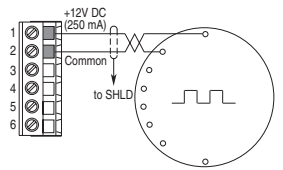
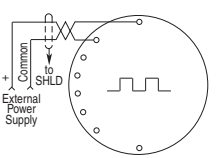
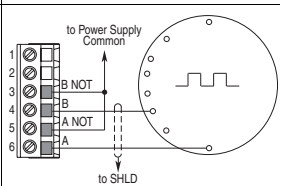
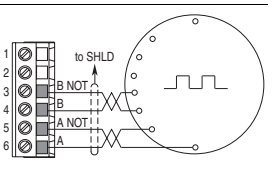


Table L Terminal Description

No.	Signal	Description
1	5-12V Power	Internal power source 250 mA (isolated).
2	Power Return	
3	Encoder B (NOT)	Single channel or quadrature B input.
4	Encoder B	
5	Encoder A (NOT)	Single channel or quadrature A input.
6	Encoder A	

Figure 4 Sample Encoder Wiring

I/O	Connection Example	I/O	Connection Example
Encoder Power – Internal Drive Power Internal (drive) 12V DC, 250mA		**Encoder Power – External Power Source**	
Encoder Signal – Single-Ended, Dual Channel		**Encoder Signal – Differential, Dual Channel**	

Encoder Specifications	Type:	Incremental, dual channel
	Supply:	5V/12V Configurable +/-5%
	Quadrature:	90° +/-27°
	Duty Cycle:	50% +10%
	Requirements	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), single-ended or differential and capable of supplying a minimum of 10 mA per channel. The Encoder Interface Board accepts 5V or 12V DC square-wave with a minimum high state voltage of 3.5V DC (5V mode) and 7.0V DC (12V mode). Maximum low state voltage is 1V DC (for both 5V and 12V modes). Maximum input frequency is 250 kHz.

Step 5 Start-Up Check List

- This check list supports the Basic Start-Up menu option. See page 39 for information on other start-up routines.
- A Human Interface Module (HIM) is required to run the Basic Start-Up routine.
- The Basic Start-Up routine may modify parameter values for Analog and Digital I/O. Refer to Common I/O Programming Changes on page 42.

ATTENTION: Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning.

Prepare For Drive Start-Up

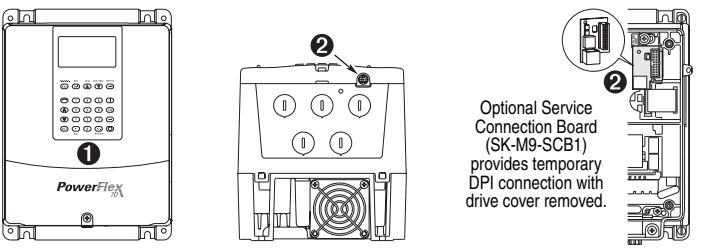
❑ **1.** Verify input supply voltage.

❑ **2.** Check output wiring.

❑ **3.** Check control wiring.

❑ **4.** Connect a Human Interface Module (HIM) to DPI Port 1 or 2.

Figure 5 DPI Ports ❶ and ❷



❑ **5.** Apply AC power and control voltages to the drive.

If any of the six digital inputs are configured to Stop – CF (CF = Clear Fault) or Enable, verify that signals are present or the drive will not start. Refer to Troubleshooting – Abbreviated Fault & Alarm Listing on page 43 for a list of potential digital input conflicts.

If the STS LED is not flashing green at this point, refer to Drive Status Indicators on page 41.

❑ **6.** When prompted, select a display language. The PowerFlex 70 Start-Up Screen will then display.

❑ **7.** Press the Enter key to display the Start-Up Menu.

❑ **8.** Use the Arrow keys to highlight “2. Basic”.

❑ **9.** Press the Enter key. Follow the menu using the Enter key which will step you through the Start-Up routine.

The Basic Start-Up routine asks simple questions and prompts you to input required information. See also Common I/O Programming Changes on page 42.

Information About Start-Up Motor Tests

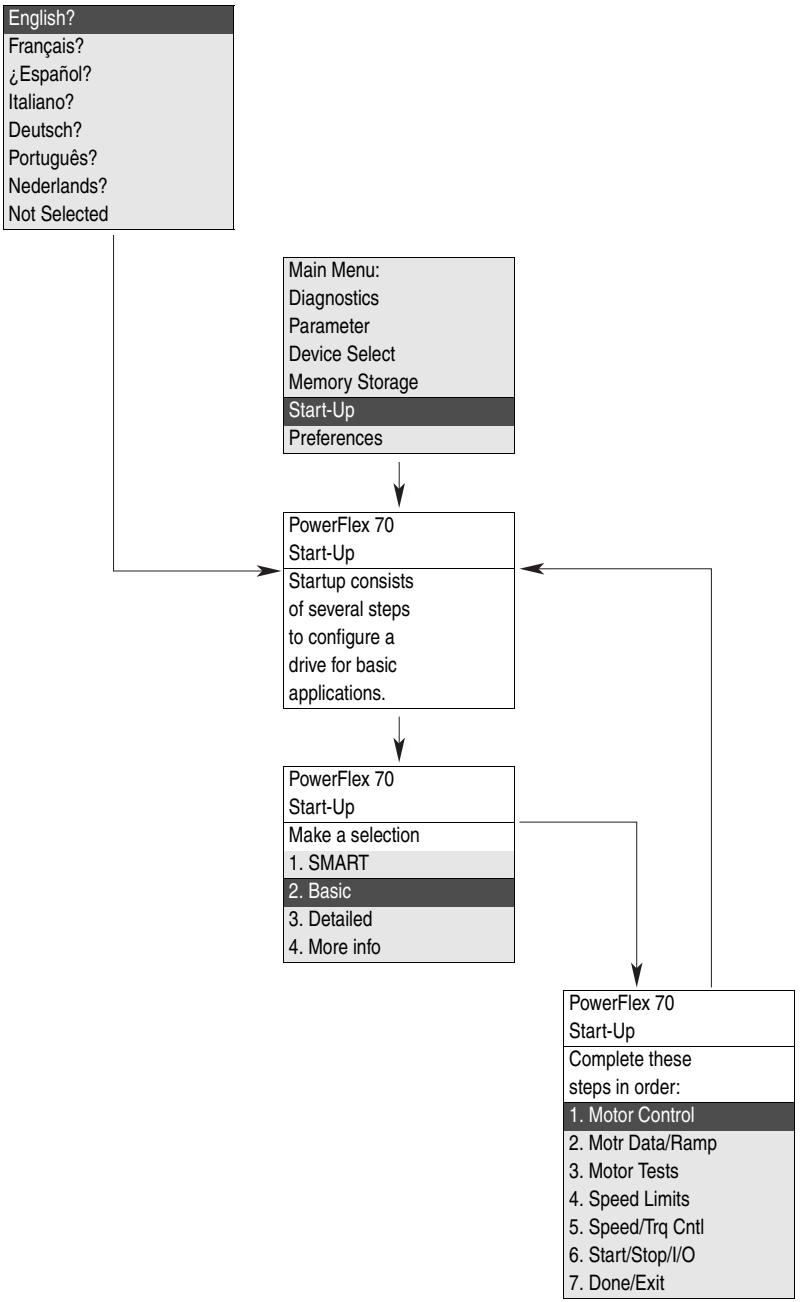
Control schemes vary based on which Start/Jog Source is selected in Step 3. Motor Tests.

Start/Jog Source	Control Source Description
Digital Inputs	Digital In 1 = Stop / Digital In 2 = Start / Digital In 3 = Jog
Local Human Interface Module (HIM)–Port 1	Human Interface Module (HIM) connected to DPI Port 1 controls Stop / Start / Jog Digital In 1…6 are temporarily disabled during motor tests.
Remote HIM	Human Interface Module (HIM) connected to DPI Port 2 controls Stop / Start / Jog Digital In 1…6 are temporarily disabled during motor tests.

During motor tests and tuning procedures, the drive may modify certain parameter values for proper Start Up operation. These values are then reset to their original values when Start Up is complete. The affected parameters are: 053, 080, 276, 278 and 361-366. If power is removed from the drive during the tests without aborting the auto-tune procedure, these parameters may not reset to their original value. If this situation occurs, reset the drive to factory defaults (see page 42) and repeat the Start Up procedure.

Appendix

First Powerup Menu Structure



Human Interface Module (HIM) Overview

LCD Display Elements

Display	Description
F-> | Power Loss | Auto 0.0 Hz Main Menu: Diagnostics Parameter Device Select	Direction | Drive Status | Alarm | Auto/Man | Information Commanded or Output Frequency Programming / Monitoring / Troubleshooting

Human Interface Module (HIM) Key Functions

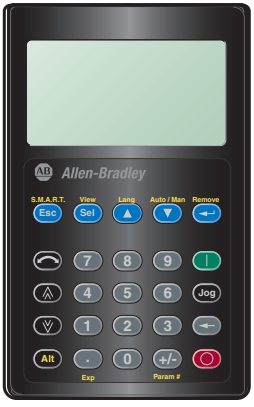
Key	Description
Esc	Exit a menu, cancel a change to a parameter value, or acknowledge a fault/alarm.
Sel	Select a digit, select a bit, or enter edit mode in a parameter screen.
▲	Scroll through options, increase a value, or toggle a bit.
▼	Scroll through options, decrease a value, or toggle a bit.
↵	Enter a menu, enter edit mode in a parameter screen, or save a change to a parameter value.
ALT	Access the function associated with a programming or numeric key. Provides access to the Large Format Display. Refer to the drive user manual for more information.
	Start the drive.
	Stop the drive or clear a fault.
Jog	Jog the drive.
	Change direction.
	Increase speed.
	Decrease speed.

These keys are active only when the HIM is granted Manual Control or Param. 090 [Speed Ref A Sel] / 093 [Speed Ref B Sel] is set to:

Option 18 “DPI Port 1” for a HIM installed in the drive cover

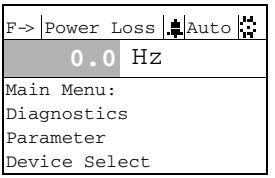
or

Option 19 “DPI Port 2” for a HIM connected by cable for handheld or remote installation option



Human Interface Module (HIM)

Human Interface Module (HIM) Main Menu

Main Menu Screen	Menu Selections
	Main Menu: Diagnostics Parameter Device Select Memory Storage Start-Up Preferences

ALT Functions

To use an ALT function, start at the Main Menu and press the ALT key, release it, then press the programming key associated with one of the following functions:

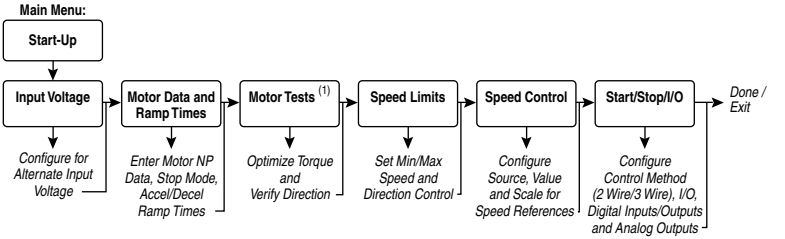
ALT Key then		Function	Function Description
ALT	Esc	S.M.A.R.T.	Displays the S.M.A.R.T. screen. This function allows the drive parameter values to be quickly programed by directly accessing the most frequently used drive functions. Refer to the User Manual for more information.
	Esc	Log In/Out	Log in to change parameter settings. Log out to protect parameter settings. Change a password.
	Sel	View	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.
	Sel	Device	Select a connected adapter for editing.
	▲	Lang	Displays the language selection screen. The LCD Human Interface Module (HIM) on an architecture class drive allows you to change the display language any time.
	▼	Auto / Man	Switches between Auto and Manual Modes. If the Human Interface Module (HIM) requests Manual Mode, the Speed Reference source is transferred to the Human Interface Module (HIM).
	↵	Remove	Allows Human Interface Module (HIM) removal without causing a fault if the Human Interface Module (HIM) is not the last controlling device and does not have Manual control of the drive.
	+/–	Param #	Allows entry of a parameter number for viewing/editing.

Start-Up Routines

The PowerFlex 70 is designed so that start up is simple and efficient. If you have an LCD HIM, two methods are provided, allowing the user to select the desired level needed for the application.

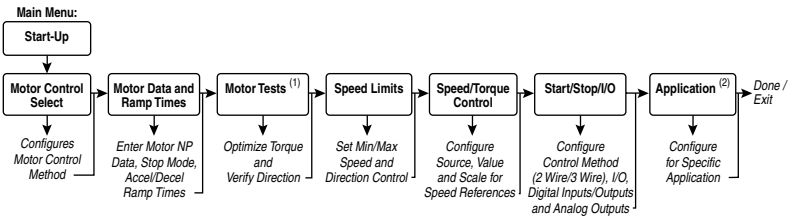
- **S.M.A.R.T. Start**
  This routine allows you to quickly set up the drive by programming values for the most commonly used functions (see below).
- **Assisted Start Up**
  This routine prompts you for information that is needed to start up a drive for most applications, such as line and motor data, commonly adjusted parameters and I/O. With Enhanced Control, two levels of Assisted Start Up are provided; Basic and Detailed.

Figure 6 Standard Control Start Up Menu



Important: Power must be applied to the drive when viewing or changing parameters. Previous programming may affect the drive status when power is applied.

Figure 7 Enhanced Control Start Up Menu



(1) During Motor Tests and tuning procedures, the drive may modify certain parameter values for proper Start Up operation. These values are then reset to their original values when Start Up is complete. The affected parameters are: 053, 080, 276, 278 and 361-366. If power is removed from the drive during the tests without aborting the auto-tune procedure, these parameters may not reset to their original value. If this situation occurs, reset the drive to factory defaults (see page 42) and repeat the Start Up procedure.

(2) Detailed start-up mode only.

Running S.M.A.R.T. Start

During a Start Up, the majority of applications require changes to only a few parameters. The LCD HIM on a PowerFlex 70 drive offers S.M.A.R.T. start, which displays the most commonly changed parameters. With these parameters, you can set the following functions:

S - Start Mode and Stop Mode
M - Minimum and Maximum Speed
A - Accel Time 1 and Decel Time 1
R - Reference Source
T - Thermal Motor Overload

To run a S.M.A.R.T. start routine:

Step	Key(s)	Example LCD Displays
1. Press ALT and then Esc (S.M.A.R.T). The S.M.A.R.T. start screen appears. 2. View and change parameter values as desired. For HIM information, see Appendix B. 3. Press Esc to exit the S.M.A.R.T. start.	ALT Esc Esc	F-> Stopped Auto SMART List: Digital In2 Sel Stop Mode A Minimum Speed

Running an Assisted Start Up

Important: This start-up routine requires an LCD HIM.

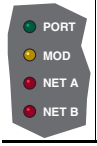
The Assisted start-up routine prompts you to input required information. Access Assisted Start Up by selecting “Start Up” from the Main Menu.

To perform an Assisted Start-Up:

Step	Key(s)	Example LCD Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to “Start Up”. 2. Press Enter.	▲ ▼ ↵	F-> Stopped Auto 0.0 Hz Main Menu: Memory Storage Start Up Preferences

Important: Done/Exit must be selected upon completion of the Start Up routine in order for any Start Up/Autotune data to be saved.

Drive Status Indicators

Name	Color	State	Description
	Green	Flashing	Drive ready, but not running and no faults are present.
		Steady	Drive running, no faults are present.
	Yellow	Flashing, Drive Stopped	An inhibit condition exists, the drive cannot be started. Check parameter 214 [Start Inhibits].
		Flashing, Drive Running	An intermittent type 1 alarm condition is occurring. Check parameter 211 [Drive Alarm 1].
		Steady, Drive Running	A continuous type 1 alarm condition exists. Check parameter 211 [Drive Alarm 1].
	Red	Flashing	A fault has occurred.
		Steady	A non-resettable fault has occurred.
	Refer to the Communication Adapter User Manual.		Status of DPI port internal communications (if present).
			Status of communications module (when installed).
			Status of network (if connected).
			Status of secondary network (if connected).

Common I/O Programming Changes

Your application needs may require changing parameters from their factory default settings.

Speed Reference A

Change Speed Reference A from Analog In 2 to Analog In 1 to connect an external potentiometer.

1. Set Param. 090 [Speed Ref A Sel] to option 1 “Analog In 1”
   This sets the speed reference input to I/O terminals 14 & 15 for voltage and I/O terminals 16 & 17 for current
2. Set Param. 096 [TB Man Ref Sel] to option 9 “MOP Level”
   This eliminates a potential Conflict alarm condition. Analog In 2 is not a valid Speed Reference source if selected for any of the following:
   - 117 [Trim In Select]
   - 126 [PI Reference Sel]
   - 128 [PI Feedback Sel]
   - 147 [Current Lmt Sel]
3. Set Param. 091 [Speed Ref A Hi] to the upper value of the desired speed reference range in Hz
4. Set Param. 092 [Speed Ref A Lo] to the lower value of the desired speed reference range in Hz

Control Scheme

Change from 3 Wire Start/Stop to 2 Wire Run/Not Run at Digital In 1 & Digital In 2.

1. Set Param. 361 [Digital In1 Sel] to option 7 “Run” or 9 “Run Reverse”
2. Set Param. 362 [Digital In2 Sel] to another option such as 8 “Run Forward” or 10 “Jog”

See I/O Wiring Examples beginning on page 29.

Restoring Factory Defaults

From the Human Interface Module (HIM) Main Menu select: Memory Storage / Reset To Defaults

Troubleshooting – Abbreviated Fault & Alarm Listing

For a complete listing of Faults and Alarms, refer to the PowerFlex 70 User Manual, publication 20A-UM001.

Fault	No.	Type(1)	Description	Action
Auxiliary Input	2	①	Auxiliary input interlock is open.	Check remote wiring.
Decel Inhibit	24	③	The drive is not following a commanded deceleration because it is attempting to limit bus voltage.	1. Verify input voltage is within drive specified limits. 2. Verify system ground impedance follows proper grounding techniques. 3. Disable bus regulation and/or add dynamic brake resistor and/or extend deceleration time.
FluxAmpsRef Rang	78		The value for flux amps determined by the Autotune procedure exceeds the programmed [Motor NP FLA].	1. Reprogram [Motor NP FLA] with the correct motor nameplate value. 2. Repeat Autotune.
HW OverCurrent	12	①	The drive output current has exceeded the hardware current limit.	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
IR Volts Range	77		"Calculate" is the autotune default and the value determined by the autotune procedure for IR Drop Volts is not in the range of acceptable values.	Re-enter motor nameplate data.
Motor Overload	7	① ③	Internal electronic overload trip. Enable/Disable with [Fault Config 1].	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by [Motor NP FLA].
OverSpeed Limit	25	①	Functions such as Slip Compensation or Bus Regulation have attempted to add an output frequency adjustment greater than that programmed in [Overspeed Limit].	Remove excessive load or overhauling conditions or increase [Overspeed Limit].
OverVoltage	5	①	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
SW OverCurrent	36	①	Drive output current has exceeded the 1ms current rating. This rating is greater than the 3 second current rating and less than the hardware overcurrent fault level. It is typically 200-250% of the drive continuous rating.	Check for excess load, improper DC boost setting. DC brake volts set too high.

(1) See the User Manual, publication 20A-UM001, for a description of fault types.

<table>
<tr><th>Alarm</th><th>No.</th><th>Type(1)</th><th>Description</th></tr>
<tr><td>Dig In ConflictA</td><td>17</td><td>②</td><td>Digital input functions are in conflict. Combinations marked with a “⚠” will cause an alarm.
<table>
<tr><th></th><th>Acc2/Dec2</th><th>Accel 2</th><th>Decel 2</th><th>Jog</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/Rev</th></tr>
<tr><td>Acc2 / Dec2</td><td></td><td>⚠</td><td>⚠</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Accel 2</td><td>⚠</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Decel 2</td><td>⚠</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog</td><td></td><td></td><td></td><td></td><td>⚠</td><td>⚠</td><td></td></tr>
<tr><td>Jog Fwd</td><td></td><td></td><td></td><td>⚠</td><td></td><td></td><td>⚠</td></tr>
<tr><td>Jog Rev</td><td></td><td></td><td></td><td>⚠</td><td></td><td></td><td>⚠</td></tr>
<tr><td>Fwd / Rev</td><td></td><td></td><td></td><td></td><td>⚠</td><td>⚠</td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictB</td><td>18</td><td>②</td><td>A digital Start input has been configured without a Stop input or other functions are in conflict. Combinations that conflict are marked with a “⚠” and will cause an alarm.
<table>
<tr><th></th><th>Start</th><th>Stop–CF</th><th>Run</th><th>Run Fwd</th><th>Run Rev</th><th>Jog</th><th>Jog Fwd</th><th>Jog Rev</th><th>Fwd/ Rev</th></tr>
<tr><td>Start</td><td></td><td></td><td>⚠</td><td>⚠</td><td>⚠</td><td></td><td>⚠</td><td>⚠</td><td></td></tr>
<tr><td>Stop–CF</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Run</td><td>⚠</td><td></td><td></td><td>⚠</td><td>⚠</td><td></td><td>⚠</td><td>⚠</td><td></td></tr>
<tr><td>Run Fwd</td><td>⚠</td><td></td><td>⚠</td><td></td><td></td><td>⚠</td><td></td><td></td><td>⚠</td></tr>
<tr><td>Run Rev</td><td>⚠</td><td></td><td>⚠</td><td></td><td></td><td>⚠</td><td></td><td></td><td>⚠</td></tr>
<tr><td>Jog</td><td></td><td></td><td></td><td>⚠</td><td>⚠</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Fwd</td><td>⚠</td><td></td><td>⚠</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Jog Rev</td><td>⚠</td><td></td><td>⚠</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fwd / Rev</td><td></td><td></td><td></td><td>⚠</td><td>⚠</td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Dig In ConflictC</td><td>19</td><td>②</td><td>More than one physical input has been configured to the same input function. Multiple configurations are not allowed for the following input functions.
Forward/Reverse
Speed Select 1
Speed Select 2
Speed Select 3
Run Forward
Run Reverse
Jog Forward
Jog Reverse
Run
Stop Mode B
Bus Regulation Mode B
Acc2 / Dec2
Accel 2
Decel 2</td></tr>
<tr><td>TB Man Ref Cflct
E C</td><td>30</td><td></td><td>Occurs when:
• “Auto/Manual” is selected (default) for [Digital In3 Sel], parameter 363
and
• [TB Man Ref Sel], parameter 96 has been reprogrammed.
No other use for the selected analog input may be programmed.
Example: If [TB Man Ref Sel] is reprogrammed to “Analog In 2,” all of the factory default uses for “Analog In 2” must be reprogrammed (such as parameters 90, 117, 128 and 179). Refer to the Auto/Manual Examples section of the PowerFlex 70 User Manual, publication 20A-UM001.
To correct:
• Verify/reprogram the parameters that reference an analog input
or
• Reprogram [Digital In3] to another function or “Unused.”</td></tr>
</table>

(1) See User Manual, publication 20A-UM001, for a description of alarm types.

Common Symptoms and Corrective Actions

Drive does not Start from Start or Run Inputs wired to the terminal block.

Cause(s)	Indication	Corrective Action
Drive is Faulted	Flashing red status light	Clear fault. • Press Stop • Cycle power • Set [Fault Clear] to 1 • "Clear Faults" on the HIM Diagnostic menu
Incorrect input wiring. See page 29 for wiring examples. • 2 wire control requires Run, Run Forward, Run Reverse or Jog input. • 3 wire control requires Start and Stop inputs • Jumper from terminal 7 to 8 is required.	Flashing green status light	Wire inputs correctly and/or install jumper.
Incorrect digital input programming. • Mutually exclusive choices have been made (i.e., Jog and Jog Forward). • 2 wire and 3 wire programming may be conflicting. • Exclusive functions (i.e, direction control) may have multiple inputs configured. • Stop is factory default and is not wired.	None	Program [Digital Inx Sel] for correct inputs. Start or Run programming may be missing.
	Flashing yellow status light and "DigIn CflctB" indication on LCD HIM. [Drive Status 2] shows type 2 alarm(s).	Program [Digital Inx Sel] to resolve conflicts. Remove multiple selections for the same function. Install stop button to apply a signal at stop terminal.
Safe-Off Option Installed • Hardware Enable Input "Digital In 6" not present.	Flashing yellow status light and "Not Enable" indication on LCD HIM.	Verify correct wiring to "Digital In 6." Check for presence of signal.
• Safe-Off Option inputs not present.	Flashing yellow status light and "Safe-Off" indication on LCD HIM.	Wire inputs correctly on Safe Off option terminals 1 through 4. Refer to the DriveGuard Safe-Off Option User Manual, publication PFLEX-UM003 for additional information

Drive does not Start from Human Interface Module (HIM).

Cause(s)	Indication	Corrective Action
Drive is programmed for 2 wire control. Human Interface Module (HIM) Start button is disabled for 2 wire control.	None	If 2 wire control is required, no action is necessary. If 3 wire control is required, program [Digital Inx Sel] for correct inputs.

Drive does not respond to changes in speed command.

Cause(s)	Indication	Corrective Action
No value is coming from the source of the command.	LCD HIM Status Line indicates "At Speed" and output is 0 Hz.	1. If the source is an analog input, check wiring and use a meter to check for presence of signal. 2. Check [Commanded Freq] for correct source.
Incorrect reference source has been programmed.	None	3. Check [Speed Ref Source] for the source of the speed reference. 4. Reprogram [Speed Ref A Sel] for correct source.
Incorrect Reference source is being selected via remote device or digital inputs.	None	5. Check [Drive Status 1], bits 12 and 13 for unexpected source selections. 6. Check [Dig In Status] to see if inputs are selecting an alternate source. 7. Reprogram digital inputs to correct "Speed Sel x" option.

Motor and/or drive will not accelerate to commanded speed.

Cause(s)	Indication	Corrective Action
Acceleration time is excessive.	None	Reprogram [Accel Time x].
Excess load or short acceleration times force the drive into current limit, slowing or stopping acceleration.	None	Check [Drive Status 2], bit 10 to see if the drive is in Current Limit. Remove excess load or reprogram [Accel Time x].
Speed command source or value is not as expected.	None	Check for the proper Speed Command using Steps 1 through 7 above.
Programming is preventing the drive output from exceeding limiting values.	None	Check [Maximum Speed] and [Maximum Freq] to assure that speed is not limited by programming.

Motor operation is unstable.

Cause(s)	Indication	Corrective Action
Motor data was incorrectly entered or Autotune was not performed.	None	1. Correctly enter motor nameplate data. 2. Perform "Static" or "Rotate" Autotune procedure.

Manually Clearing Faults

Step	Key(s)
1. Press Esc to acknowledge the fault. The fault information will be removed so that you can use the Human Interface Module (HIM). 2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared. 3. After corrective action has been taken, clear the fault by one of these methods: • Press Stop • Cycle drive power • Set parameter 240 [Fault Clear] to “1.” • “Clear Faults” on the Human Interface Module (HIM) Diagnostic menu.	

Parameter List

Number	Parameter Name	Group
1	Output Freq	Metering
2	Commanded Freq	Metering
3	Output Current	Metering
4	Torque Current	Metering
5	Flux Current	Metering
6	Output Voltage	Metering
7	Output Power	Metering
8	Output Powr Fctr	Metering
9	Elapsed MWh	Metering
10	Elapsed Run Time	Metering
11	MOP Frequency	Metering
12	DC Bus Voltage	Metering
13	DC Bus Memory	Metering
14	Elapsed kWh	Metering
15	Torque Estimate[3.x]	Metering
16	Analog In1 Value	Metering
17	Analog In2 Value	Metering
22	Ramped Speed	Metering
23	Speed Reference	Metering
24	Commanded Torque**	Metering
25	Speed Feedback	Metering
26	Rated kW	Drive Data
27	Rated Volts	Drive Data
28	Rated Amps	Drive Data
29	Control SW Ver	Drive Data
40	Motor Type	Motor Data
41	Motor NP Volts	Motor Data
42	Motor NP FLA	Motor Data
43	Motor NP Hertz	Motor Data
44	Motor NP RPM	Motor Data
45	Motor NP Power	Motor Data
46	Mtr NP Pwr Units	Motor Data
47	Motor OL Hertz	Motor Data
48	Motor OL Factor	Motor Data
49	Motor Poles	Motor Data
50	Motor OL Mode[3.x]	Motor Data
53	Motor Cntl Sel	Torq Attributes
53	Torque Perf Mode	Torq Attributes
54	Maximum Voltage	Torq Attributes
55	Maximum Freq	Torq Attributes
56	Compensation	Torq Attributes
57	Flux Up Mode	Torq Attributes
58	Flux Up Time	Torq Attributes
59	SV Boost Filter	Torq Attributes
61	Autotune	Torq Attributes
62	IR Voltage Drop	Torq Attributes
63	Flux Current Ref	Torq Attributes
64	Ixo Voltage Drop	Torq Attributes
66	Autotune Torque**	Torq Attributes
67	Inertia Autotune**	Torq Attributes

Number	Parameter Name	Group
69	Start/Acc Boost*	Volts per Hertz
70	Run Boost*	Volts per Hertz
71	Break Voltage*	Volts per Hertz
72	Break Frequency*	Volts per Hertz
80	Feedback Select	Spd Mode & Limits
80	Speed Mode	Spd Mode & Limits
81	Minimum Speed	Spd Mode & Limits
82	Maximum Speed	Spd Mode & Limits
83	Overspeed Limit	Spd Mode & Limits
84-86	Skip Frequency X	Spd Mode & Limits
87	Skip Freq Band	Spd Mode & Limits
88	Speed/Torque Mod**	Spd Mode & Limits
90, 93	Speed Ref X Sel	Speed Reference
91, 94	Speed Ref X Hi	Speed Reference
92, 95	Speed Ref X Lo	Speed Reference
96	TB Man Ref Sel	Speed Reference
97	TB Man Ref Hi	Speed Reference
98	TB Man Ref Lo	Speed Reference
100	Jog Speed	Discrete Speeds
100	Jog Speed 1	Discrete Speeds
101-107	Preset Speed X	Discrete Speeds
108	Jog Speed 2	Discrete Speeds
116	Trim % Setpoint	Speed Trim
117	Trim In Select	Speed Trim
118	Trim Out Select	Speed Trim
119	Trim Hi	Speed Trim
120	Trim Lo	Speed Trim
121	Slip RPM @ FLA	Slip Comp
122	Slip Comp Gain*	Slip Comp
123	Slip RPM Meter	Slip Comp
124	PI Configuration	Process PI
125	PI Control	Process PI
126	PI Reference Sel	Process PI
127	PI Setpoint	Process PI
128	PI Feedback Sel	Process PI
129	PI Integral Time	Process PI
130	PI Prop Gain	Process PI
131	PI Lower Limit	Process PI
132	PI Upper Limit	Process PI
133	PI Preload	Process PI
134	PI Status	Process PI
135	PI Ref Meter	Process PI
136	PI Fdback Meter	Process PI
137	PI Error Meter	Process PI
138	PI Output Meter	Process PI
139	PI BW Filter	Process PI
140, 141	Accel Time X	Ramp Rates
142, 143	Decel Time X	Ramp Rates
145	DB While Stopped	Stop/Brake Modes
146	S Curve %	Ramp Rates

Number	Parameter Name	Group
147	Current Lmt Sel	Load Limits
148	Current Lmt Val	Load Limits
149	Current Lmt Gain	Load Limits
150	Drive OL Mode	Load Limits
151	PWM Frequency	Load Limits
152	Droop RPM @ FLA	Stop/Brake Modes
153	Regen Power Lim**	Load Limits
154	Current Rate Lim**	Load Limits
155, 156	Stop/Brk Mode X[EC v2]	Stop/Brake Modes
155, 156	Stop Mode X[Standard]	Stop/Brake Modes
157	DC Brake Lvl Sel	Stop/Brake Modes
158	DC Brake Level	Stop/Brake Modes
159	DC Brake Time	Stop/Brake Modes
160	Bus Reg Gain	Stop/Brake Modes
160	Bus Reg Ki*	Stop/Brake Modes
161, 162	Bus Reg Mode X	Stop/Brake Modes
163	DB Resistor Type	Stop/Brake Modes
164	Bus Reg Kp*	Stop/Brake Modes
165	Bus Reg Kd*	Stop/Brake Modes
166	Flux Braking	Stop/Brake Modes
167	Powerup Delay	Restart Modes
168	Start At PowerUp	Restart Modes
169	Flying Start En	Restart Modes
170	Flying StartGain	Restart Modes
174	Auto Rstrt Tries	Restart Modes
175	Auto Rstrt Delay	Restart Modes
177	Gnd Warn Level	Restart Modes
178	Sleep Wake Mode	Restart Modes
179	Sleep Wake Ref	Restart Modes
180	Wake Level	Restart Modes
181	Wake Time	Restart Modes
182	Sleep Level	Restart Modes
183	Sleep Time	Restart Modes
184	Power Loss Mode	Power Loss
185	Power Loss Time	Power Loss
187	Load Loss Level	Power Loss
188	Load Loss Time	Power Loss
189	Shear Pin Time	Load Limits
190	Direction Mode	Direction Config
192	AutoMan Cnfg	HIM Ref Config
192	Save HIM Ref	HIM Ref Config
193	Man Ref Preload	HIM Ref Config
194	Save MOP Ref	MOP Config
195	MOP Rate	MOP Config
196	Param Access Lvl	Drive Memory
197	Reset To Defalts	Drive Memory
198	Load Frm Usr Set	Drive Memory
199	Save To User Set	Drive Memory
200	Reset Meters	Drive Memory
201	Language	Drive Memory
202	Voltage Class	Drive Memory
203	Drive Checksum	Drive Memory
204	Dyn UsrSet Cnfg	Drive memory

Number	Parameter Name	Group
205	Dyn UsrSet Sel	Drive memory
206	Dyn UserSet Actv	Drive Memory
209, 210	Drive Status 1, 2	Diagnostics
211, 212	Drive Alarm X	Diagnostics
213	Speed Ref Source	Diagnostics
214	Start Inhibits	Diagnostics
215	Last Stop Source	Diagnostics
216	Dig In Status	Diagnostics
217	Dig Out Status	Diagnostics
218	Drive Temp	Diagnostics
219	Drive OL Count	Diagnostics
220	Motor OL Count	Diagnostics
221	Mtr OL Trip Time[3.x]	Diagnostics
222	Drive Status 3[3.x]	Diagnostics
223	Status 3 @ Fault[3.x]	Diagnostics
224	Fault Frequency	Diagnostics
225	Fault Amps	Diagnostics
226	Fault Bus Volts	Diagnostics
227, 228	Status X @ Fault	Diagnostics
229, 230	Alarm X @ Fault	Diagnostics
234, 236	Testpoint X Sel	Diagnostics
235, 237	Testpoint X Data	Diagnostics
238	Fault Config 1	Faults
240	Fault Clear	Faults
241	Fault Clear Mode	Faults
242	Power Up Marker	Faults
243-249	Fault X Code	Faults
244-250	Fault X Time	Faults
259	Alarm Config 1	Alarms
270	DPI Data Rate	Comm Control
271	Drive Logic Rslt	Comm Control
272	Drive Ref Rslt	Comm Control
273	Drive Ramp Rslt	Comm Control
274	DPI Port Select	Comm Control
275	DPI Port Value	Comm Control
276	Logic Mask	Masks & Owners
277	Start Mask	Masks & Owners
278	Jog Mask	Masks & Owners
279	Direction Mask	Masks & Owners
280	Reference Mask	Masks & Owners
281	Accel Mask	Masks & Owners
282	Decel Mask	Masks & Owners
283	Fault Clr Mask	Masks & Owners
284	MOP Mask	Masks & Owners
285	Local Mask	Masks & Owners
288	Stop Owner	Masks & Owners
289	Start Owner	Masks & Owners
290	Jog Owner	Masks & Owners
291	Direction Owner	Masks & Owners
292	Reference Owner	Masks & Owners
293	Accel Owner	Masks & Owners
294	Decel Owner	Masks & Owners
295	Fault Clr Owner	Masks & Owners

Number	Parameter Name	Group
296	MOP Owner	Masks & Owners
297	Local Owner	Masks & Owners
298	DPI Ref Select	Comm Control
300-307	Data In XX	Datalinks
308	HighRes Ref	Datalinks
310-317	Data Out XX	Datalinks
320	Anlg In Config	Analog Inputs
321	Anlg In Sqr Root	Analog Inputs
322, 325	Analog In X Hi	Analog Inputs
323, 326	Analog In X Lo	Analog Inputs
324, 327	Analog In X Loss	Analog Inputs
340	Anlg Out Config	Analog Outputs
341	Anlg Out Absolut	Analog Outputs
342	Analog Out1 Sel	Analog Outputs
343	Analog Out1 Hi	Analog Outputs
344	Analog Out1 Lo	Analog Outputs
354	Anlg Out1 Scale	Analog Outputs
361-366	Digital InX Sel	Digital Inputs
377	Anlg Out1 Setpt	Analog Outputs
379	Dig Out Setpt	Digital Outputs
380, 384	Digital OutX Sel	Digital Outputs
381, 385	Dig OutX Level	Digital Outputs
382, 386	Dig OutX OnTime	Digital Outputs
383, 387	Dig OutX OffTime	Digital Outputs
411	DigIn DataLogic	Digital Inputs
412	Motor Fdbk Type**	Speed Feedback
413	Encoder PPR**	Speed Feedback
414	Enc Pos Feedback	Speed Feedback
415	Encoder Speed	Speed Feedback
416	Fdbk Filter Sel**	Speed Feedback
419	Notch FilterFreq**	Speed Feedback
420	Notch Filter K**	Speed Feedback
427	Torque Ref A Sel**	Torq Attributes
428	Torque Ref A Hi**	Torq Attributes
429	Torque Ref A Lo**	Torq Attributes
435	Torque Setpoint1**	Torq Attributes
436	Pos Torque Limit**	Torq Attributes
437	Neg Torque Limit**	Torq Attributes
440	Control Status	Torq Attributes
441	Torq Current Ref	Torq Attributes
445	Ki Speed Loop**	Speed Regulator
446	Kp Speed Loop**	Speed Regulator
447	Kf Speed Loop**	Speed Regulator
448	Spd Err Filt BW[3.x]	Speed Regulator
449	Speed Desired BW**	Speed Regulator
450	Total Inertia**	Speed Regulator
451	Speed Loop Meter**	Speed Regulator
454	Rev Speed Limit	Spd Mode & Limits
459	PI Deriv Time	Process PI
460	PI Reference Hi	Process PI
461	PI Reference Lo	Process PI
462	PI Feedback Hi	Process PI
463	PI Feedback Lo	Process PI

Number	Parameter Name	Group
476, 482	ScaleX In Value	Scaled Blocks
477, 483	ScaleX In Hi	Scaled Blocks
478, 484	ScaleX In Lo	Scaled Blocks
595	Port Mask Act	Security
596	Write Mask Cfg	Security
597	Write Mask Act	Security
598	Logic Mask Act	Security
620	Fiber Control	Fiber Functions[3.x]
621	Fiber Status	Fiber Functions[3.x]
622	Sync Time	Fiber Functions[3.x]
623	Traverse Inc	Fiber Functions[3.x]
624	Traverse Dec	Fiber Functions[3.x]
625	Max Traverse	Fiber Functions[3.x]
626	P Jump	Fiber Functions[3.x]

* These parameters will only be displayed when parameter 053 [Motor Cntl Sel] is set to option "2 or 3."

** These parameters will only be displayed when parameter 053 [Motor Cntl Sel] is set to option "4."

[3.x] Firmware 3.002 & later only.

Notes:

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